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DEVICE FOR A BATTERY CHARGER

TECHNICAL AREA

The present invention relates to a device for controlling the current of a battery charger, and in particular a primary switched charger.

BACKGROUND OF THE INVENTION

The charging of batteries should be performed as carefully as possible in order not to damage the battery or reduce its capacity and at the same time the charging should be performed as quickly as possible, these two criteria cannot always be obtained at the same time. In order to shorten the charging time, the charging current can be increased. A high charging current can however damage the battery. To this end the battery manufacturers have strict instructions on how high a charging current is allowed to be as a function of battery size. A normal recommendation is that the charging current is obtained by multiplying the capacity of the battery in ampere hours with 0,1, ie a 20 Ah battery should be charged with 2 A.

A battery charger is therefore "locked" in a window between being too small, with long charging time, and too large, with detrimental influence on the battery life. As a consequence of this, users with a number of different battery sizes are forced to have a number of different battery chargers, alternatively they charge outside the recommendations of the manufacturers. For all charging of batteries, the final charging voltage has a large impact on the life of the battery. A too high voltage means that the battery develops gas with an increased concentration of sulphuric acid and accelerated grid corrosion as a consequence. A too low voltage means an uncompleted charging with partial sulphating and lost battery capacity as a consequence. A third parameter is that current ripple shall be kept low as it cause an increase in the battery temperature during charging with a decreased life as a consequence.

On linear chargers, ie chargers arranged with a transformer that converts the mains voltage to charging voltage, which are the predominant type for chargers, the current may be controlled in that the transformer is provided with several primary windings and the output voltage is varied by choice of primary winding. Due to this, the output voltage is altered and because the current is proportional to the voltage, the current can be affected. The drawback with this type is apparent on an unregulated linear charger because the voltage to the battery can rise to levels which are detrimental to the battery if quick charging is required and a too low voltage level if it is desired to reduce the current. Ripple is something undesirable on a charger due to the above mentioned problems. The development trend regarding battery chargers is a transfer to primary switched devices, which offer a more exact control of voltage and current and at the same time smaller dimensions. There exists today, as far as the inventors are aware, no changeable output currents on primary switched chargers.

BRIEF DESCRIPTION OF THE INVENTION

The aim of the present invention is to provide a primary switched charger where the user can choose one or more current levels. Because of this, charging parameters can be adapted in order to provide the right treatment of the battery and one single charger can be adequately used for different types and sizes of batteries.

According to one aspect of the invention it discloses a device for reducing the output current of a primary switched battery charger, which charger comprises an input DC power circuit, a high frequency transformer and control unit for modulating the DC input power, characterised in that it comprises means for measuring pulse ratio of switch pulses on the output side of the charger, means for measuring peak value of output voltage, means for differentially amplifying the signals measured and means for integrating voltage/current of the differentially amplified signals, wherein the integrated voltage/current is

used for modulating the input DC power in order to reduce the output current.

The advantage with the present invention is that the design provides a good possibility to reduce the charging current to the battery on the output side and is at the same time very cost efficient. A current limitation is possible to perform in the interval of around 5% to 30% of the maximum current. The current regulation will partly be reciprocally proportional to increased load, ie the charging current decreases with increased load. Maximum current is therefore obtained just before the voltage regulation cuts in during reduced load.

These and other aspects of, and advantages with, the present invention will become apparent from the detailed description of the invention and from the accompanying drawings.

SHORT DESCRIPTION OF THE DRAWINGS

In the following description of the invention, reference will be made to the following drawings, of which

Fig. 1 shows a circuit configuration of a battery charger comprising the current device according to the invention, and

Fig. 2 shows a block diagram of the current device of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The battery charger shown in Fig. 1 is a primary switched charger comprising in a known manner a DC power circuit 8 connectable to the mains, a diode bridge 10, a smoothing capacitor 12 and a high frequency transformer 14. The smoothing capacitor stores energy as a high DC voltage. The transformer transforms the high voltage to a charging voltage. A control circuit 16 comprising an electronic switch, like a field effect transistor FET, is arranged to the DC power circuit and the transformer capable of chopping up the DC power from the DC

power circuit into pulses, and controlling and modulating the width of the pulses PWM. Auxiliary circuitry for the pulse width modulation may also be arranged, but is not described here, because they do not form part of the present invention.

On the output side of the high frequency transformer are two lines, positive 18 and negative 20, provided with means to connect to a battery 21. A rectifying diode 22 is arranged to the positive line, and a smoothing capacitor 24 is arranged between the positive and negative line.

The device according to the invention for providing a low current comprises a circuit 26 for measuring pulse ratio of switch pulses on the output side of the high frequency transformer, connected via a line 28 to the positive line 18. It further comprises a circuit 28 for measuring peak values of the output voltage, connected between the positive and the negative lines. Output signals from the pulse ratio circuit 26 and the peak value circuit 28 are fed via lines 30, 32 to a differential amplifier 34 for the peak values / pulse ratios.

An integrating amplifier 36 for feed-back of voltage / current is arranged with an input line 38 from the positive line 18. A second input line 40 provided with a breaker 42 is provided from the differential amplifier 34 for activating/deactivating a low-current area. A feed-back line 44 is provided from the integrating amplifier 36 to the control circuit 16 to be used for PWM.

Figure 2 shows a block diagram of the components of the different circuitry comprised in the present invention.

As seen, the pulse ratio circuit 26 comprises a diode 50 connected to line 28 and a resistor 52 in series with the diode. The resistor is in turn

connected to a second resistor 54 and a capacitor 56 arranged in parallel with each other and connected to earth.

The peak value circuit 28 comprises two resistors 58 and 60 connected in series with each other and between the positive line 18 and the negative line 20.

The differential amplifier 34 comprises a transistor 62 where its emitter is connected via line 64 between the resistors 58, 60 of the peak value circuit 28. The base of the transmitter is connected via a resistor between the resistor 52 and the resistor/capacitor 54, 56 of the pulse ratio circuit 26. Further, the collector of the transistor is connected to a resistor 68 and a capacitor 70 arranged in parallel with each other and connected to earth.

The integrating amplifier 36 comprises a transistor 72, where its base is connected to the collector of the transistor 62. The emitter of the transistor 72 is connected to earth via a resistor 74. The collector of the transistor is connected to the base of a second transistor 76. The collector of the second transistor is connected to the positive line 18 via a line 78 and a resistor 80. A further line 82 is arranged between the line 78 and the collector of the first transistor 72, which line is arranged with a resistor 84. The emitter of the second transistor 76 is connected to the line 78 and a resistor 86 is arranged between the connection and the positive line 18. A trimming potentiometer 88 is also connected to the line 78 and earth. The feed-back line 44 is connected to line 78 between the resistor 86 and the trimming potentionmeter.

The breaker 42 for activating/deactivating the low-current area comprises a transistor 90 with its collector connected between the collector the first transistor 72 and the base of the second transistor 76 of the integrating amplifier 36. The emitter of the transmitter 90 is connected to earth. The base is via a resistor 92 connected to an

electronic switch so that the low-current area of the charging can be chosen by an operator.

The design according to the invention provides a good possibility to reduce the charging current to the battery on the output side and is at the same time very cost efficient. A current limitation is possible to perform in the interval of around 5% to 30% of the maximum current. The current regulation will partly be reciprocally proportional to increased load, ie the charging current decreases with increased load. Maximum current is therefore obtained just before the voltage regulation cuts in during reduced load.

It is to be understood that the embodiment described above and shown in the drawings may be modified in many ways within the scope of the patent claims.

PATENT CLAIMS

1. Device for reducing the output current of a primary switched battery charger, which charger comprises an input DC power circuit, a high frequency transformer and control unit for modulating the DC input power, characterised in that it comprises means for measuring pulse ratio of switch pulses on the output side of the charger, means for measuring peak value of output voltage, means for differentially amplifying the signals measured and means for integrating voltage/current of the differentially amplified signals, wherein the integrated voltage/current is used for modulating the input DC power in order to reduce the output current.

2. Device according to claim 1, characterised in a switch capable of switching on and off the connection between the means for differentially amplifying and the means for integrating.

ABSTRACT

The present invention relates to a device for reducing the output current of a primary switched battery charger, which charger comprises an input DC power circuit, a high frequency transformer and control unit for modulating the DC input power. The invention is characterised in that it comprises means for measuring pulse ratio of switch pulses on the output side of the charger, means for measuring peak value of output voltage, means for differentially amplifying the signals measured and means for integrating voltage/current of the differentially amplified signals, wherein the integrated voltage/current is used for modulating the input DC power in order to reduce the output current.

(Fig. 1)

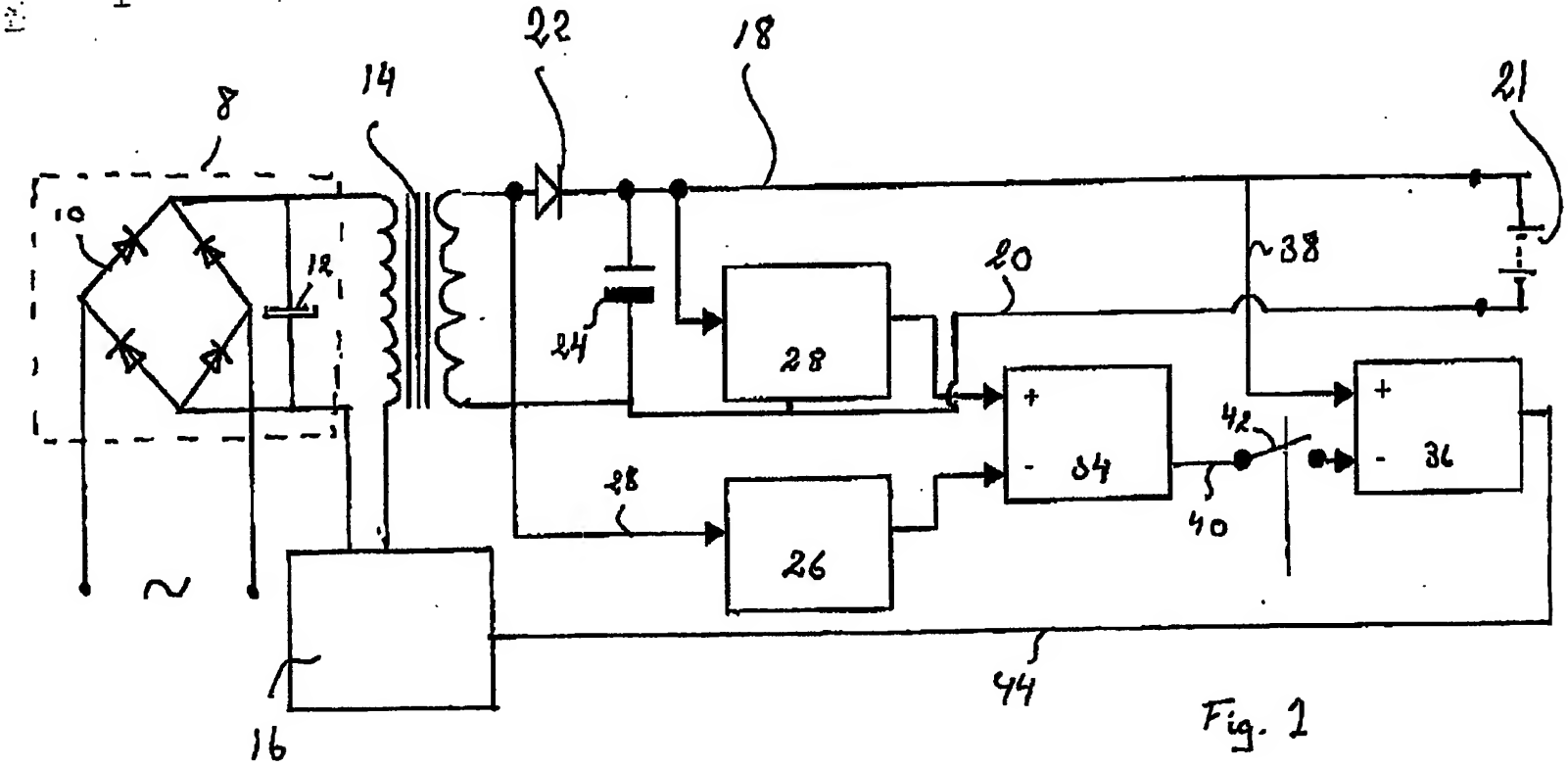

Fig. 1

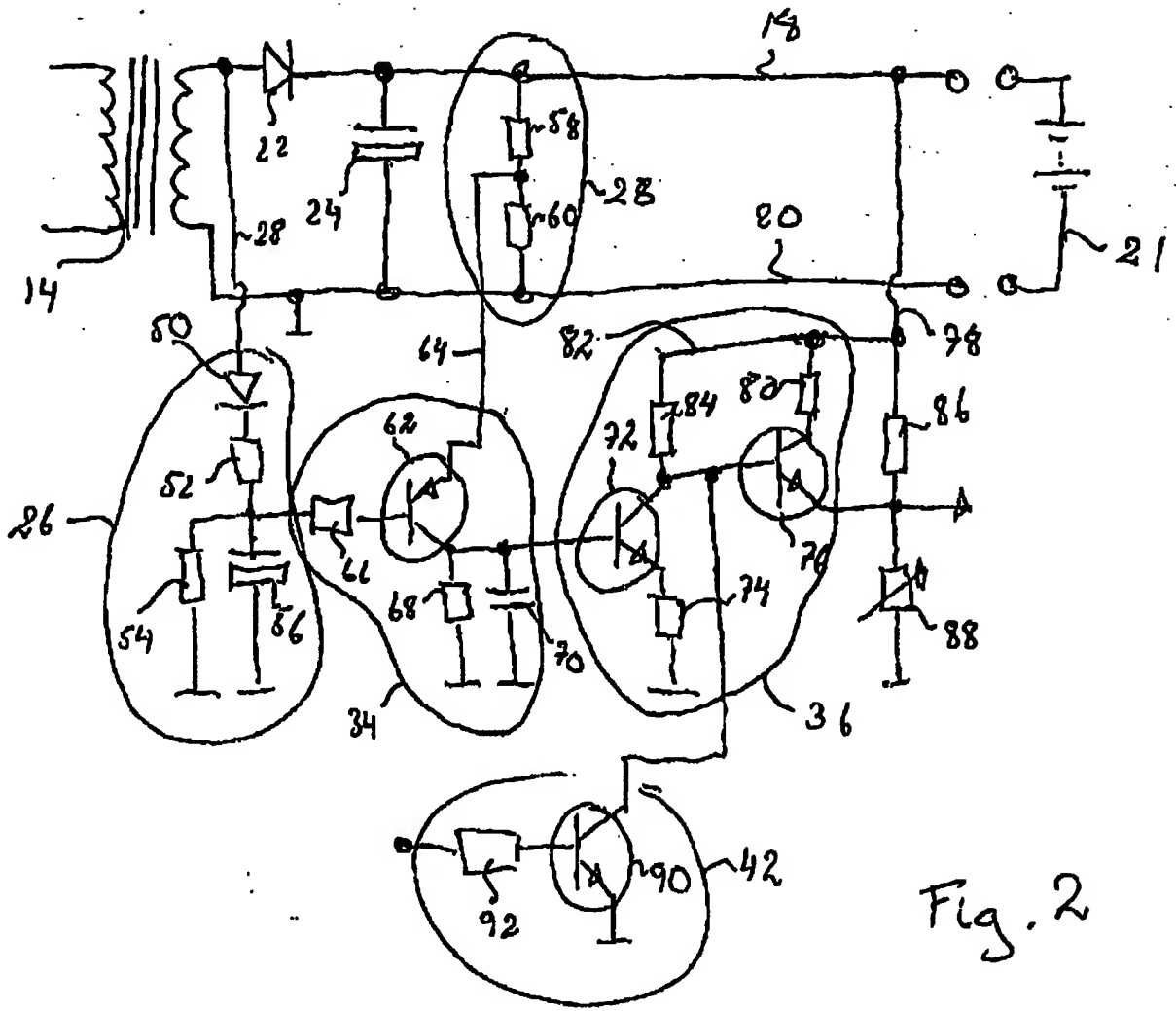

Fig. 2